

STAT

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INTRODUCTION

Spring steels are intended for manufacturing flat springs and coiled springs.

The springs flat or coiled are used for even distribution of moving mechanism weight between the axles of railroad cars, automobiles, etc., and for cushioning of shocks resulting from the wheels bumps against rough roads.

The springs should withstand the load acting upon them, without producing permanent deformation and possess sufficient elasticity. As to the types, the springs are classified as coiled (spiral) and flat springs. The flat springs consist of a pack of steel leaves placed one upon another, and gradually shortening to the point of the highest bending moment of the spring. In the middle of the pack, the leaves are fastened between themselves by a strain bolt or a clip. The cramps or clips are used to prevent any side displacement of the spring leaves.

The springs are made of different types of high grade or extra high grade steels, delivered according to the USSR standards ГОСТ 2052-53 or ГОСТ 4555-48.

HIGH GRADE HOT-ROLLED SPRING STEEL

The coiled or flat springs are manufactured of high grade carbon and alloy steels, made by either open-hearth or electric furnace processes. These steels are delivered in hot-rolled unannealed state, according to the USSR Standard ГОСТ 2052-53. The chemical compositions of the steels are given in Table 1.

The residual copper content in spring steel shall not exceed 0.25 per cent.

At the purchaser's request the spring steel may be furnished with narrower limits of carbon content, i. e., up to 0.05 per cent, and with lower sulphur and phosphorus content than that indicated in Table 1. The spring steel may also be furnished in the annealed state.

It is guaranteed that the surface of steel rolled product, when examined by the naked eye shall be free of cracks, scales, laps, gas cavities, bubbles, sand inclusions, hair cracks and laminations. Local defects can be removed by chipping or grinding, with dimensions of steel profiles at points of cleaning being within the limits established by the corresponding standards or technical specifications for minimum dimensions.

When examined by the naked eye, the macrostructure of spring steel in fractures and etched transverse templates shall be free from signs of piping, voids, cracks, bubbles and slag inclusions.

Unannealed steel intended for cold mechanical working in the state of delivery, possesses the following hardness (see Table 2).

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TABLE 1

Group of Steel	Grade of Steel	Chemical Composition, per cent							Sulphur maximum	Phosphorus maximum
		Carbon	Manganese	Silicon	Chrome	Nickel	Tungsten			
Carbon Steel	65	0.60 - 0.70	0.50 - 0.80	0.17 - 0.37	up to 0.30	up to 0.30		0.045	0.040	
	70	0.65 - 0.75	0.50 - 0.80	0.17 - 0.37	up to 0.30	up to 0.30		0.045	0.040	
	75	0.72 - 0.80	0.50 - 0.80	0.17 - 0.37	up to 0.30	up to 0.30		0.045	0.040	
	85	0.82 - 0.90	0.50 - 0.80	0.17 - 0.37	up to 0.30	up to 0.30		0.045	0.040	
Manganese Steel	65T	0.60 - 0.70	0.90 - 1.20	0.17 - 0.37	up to 0.30	up to 0.30		0.045	0.040	
	65TC	0.50 - 0.60	0.60 - 0.90	0.50 - 0.80	up to 0.30	up to 0.40		0.040	0.040	
Silicon Steel	50C2	0.47 - 0.55	0.60 - 0.90	1.50 - 2.00	up to 0.30	up to 0.40		0.040	0.040	
	55C2	0.52 - 0.60	0.60 - 0.90	1.50 - 2.00	up to 0.30	up to 0.40		0.040	0.040	
	60C2	0.57 - 0.65	0.60 - 0.90	1.50 - 2.00	up to 0.30	up to 0.40		0.040	0.040	
	60C2A	0.56 - 0.64	0.60 - 0.90	1.60 - 2.00	up to 0.30	up to 0.40		0.040	0.040	
	70C3A	0.66 - 0.74	0.60 - 0.90	2.40 - 2.80	up to 0.30	up to 0.40		0.040	0.040	
	63C2A	0.60 - 0.75	0.60 - 0.90	1.80 - 2.20	up to 0.30	up to 0.40		0.040	0.040	
Silicon-Manganese Steel	55CT	0.50 - 0.60	0.80 - 1.00	1.30 - 1.80	up to 0.30	up to 0.40		0.040	0.040	
	60CT	0.55 - 0.65	0.80 - 1.00	1.30 - 1.80	up to 0.30	up to 0.40		0.040	0.040	
	60CTA	0.56 - 0.64	0.80 - 1.00	1.30 - 1.80	up to 0.30	up to 0.40		0.040	0.040	
Chrome-Manganese Steel	50XT	0.46 - 0.54	0.70 - 1.00	0.17 - 0.37	0.90 - 1.20	up to 0.40		0.040	0.040	
	50XTA	0.46 - 0.54	0.80 - 1.00	0.17 - 0.37	0.95 - 1.20	up to 0.40		0.040	0.040	
Chrome-Silicon Steel	60C2XA	0.56 - 0.64	0.40 - 0.70	1.40 - 1.80	0.70 - 1.00	up to 0.40		0.040	0.040	
Chrome-Vanadium Steel	50XΦA	0.46 - 0.54	0.50 - 0.80	0.17 - 0.37	0.80 - 1.10	up to 0.40	0.10 - 0.20	0.040	0.040	
Chrome-Manganese-Vanadium Steel	50XTΦA	0.48 - 0.55	0.80 - 1.00	0.17 - 0.37	0.95 - 1.20	up to 0.40	0.15 - 0.25	0.040	0.040	
Chrome-Silicon-Vanadium Steel	60C2XΦA	0.56 - 0.64	0.40 - 0.70	1.40 - 1.80	0.90 - 1.20	up to 0.40	0.10 - 0.20	0.040	0.040	
Tungsten-Silicon Steel	65C2BA	0.61 - 0.69	0.70 - 1.00	1.50 - 2.00	up to 0.30	up to 0.40	0.80 - 1.20	0.040	0.040	
Nickel-Silicon Steel	60C2H2A	0.56 - 0.64	0.40 - 0.70	1.40 - 1.80	up to 0.30	1.40 - 1.70		0.040	0.040	

TABLE 2

Grade of Steel	Diameter of Impression mm minimum	Brinell Hardness H _B maximum	Grade of Steel	Diameter of Impression mm minimum	Brinell Hardness H _B maximum
65	3.5	255	60C2 60C2A	3.5	302
70	3.7	269	70C3A 50XF		
75	3.6	285	50XFA		
85	3.5	302	50XΦA 63C2A 60C2XΦA 65C2BA		
65F	3.7	269	60C2H2A		
55FC 50C2 55C2 55CF 60CF 60CFA	3.6	285	60C2XA 50XFΦA	3.4	321

When the annealed steel is ordered the hardness is stipulated by special technical specifications.

The following physical properties are guaranteed for the heat treated specimens of spring steel subjected to a tensile test at tension (see Table 3).

TABLE 3

Grade of Steel	Heat Treatment (approximately)			Physical Properties			
	Hardening Temperature	Quenching Medium	Tempering Temperature	Yield Point	Tensile Strength	Elongation	Reduction of Area
	°C		°C	kg/sq. mm	kg/sq. mm	per cent	per cent
				minimum			
65	840	Oil	480	80	100	9	35
70	830	Oil	480	85	105	8	30
75	820	Oil	480	90	110	7	30
85	820	Oil	480	100	115	6	30
65F	830	Oil	480	80	100	8	30
55FC	820	Oil	480	80	100	8	30

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Continuation of TABLE 3

Grade of Steel	Heat Treatment (approximately)			Physical Properties			
	Hardening Temperature	Quenching Medium	Tempering Temperature	Yield Point	Tensile Strength	Elongation	Reduction of Area
	°C		°C	kg/sq. mm	kg/sq. mm	per cent	per cent
				minimum			
50C2	870	Oil	400	110	120	6	30
55C2	870	Oil or Water		120	130	6	30
60C2	870	Oil	400	120	130	5	25
60C2A	870	Oil	400	140	160	5	25
62C2A	850	Oil	460	140	160	5	20
70C3A	850	Oil	460	160	180	5	25
55CT	850	Oil	480	120	130	6	30
60CT	860	Oil	460	120	130	5	25
60CTA	860	Oil	460	140	160	5	25
50XT	840	Oil	490	110	130	5	35
50XTA	840	Oil	490	120	130	6	35
50XΦA	850	Oil	520	110	130	10	45
50XTΦA	850	Oil	520	120	130	6	35
60C2XA	870	Oil	420	160	180	5	20
60C2XΦA	850	Oil	410	170	190	5	20
65C2BA	850	Oil	420	170	190	5	20
60C2H2A	850	Oil	420	160	175	5	20

The results of determining the reduction of area on the flat tension specimens are for information only (facultative).

The spring steels are delivered with guaranteed limits of decarburization zone.

For thickness of flats or diameter of bars in millimeters (diameter or distance between parallel sides of squares) the depth of the decarburization zone shall not exceed the following limits:

a) for flats and bars of all grades of steel, excluding silicon alloy steel:

up to 8 mm inclusive 2 per cent of the thickness of flats or bars
over 8 mm 1,5 per cent of the thickness of flats or bars

b) for flats and bars of steel grades alloyed with silicon:

up to 8 mm inclusive 2,5 per cent of the thickness of flats or bars
over 8 mm 2,0 per cent of the thickness of flats or bars

Hardness, physical properties and depth of decarburization for steels of grades 55 CT, 60 C and 60 CTA are given for information only (facultative).

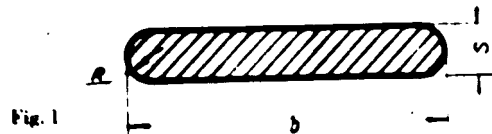
The grain size for steel grade 50 XTΦA is guaranteed to be within numbers 5—8 according to the USSR Standard ГОСТ 5639-51.

At the purchaser's request steel of all grades is subjected to bend tests. The requirements and limits of these bend tests are stipulated in technical specifications.

The spring steels are furnished in the following shapes: rounds — from 5 to 50 mm inclusive, and squares — from 6 to 50 mm inclusive.

The following types of flat spring steel are manufactured:

1. Type A: flat spring steel of rectangular cross-section (with slightly blunt corners) is furnished in width from 20 to 160 mm inclusive and in thickness from 4 to 18 mm inclusive.
2. Type B: flat spring steel with rounded edges (Fig. 1).

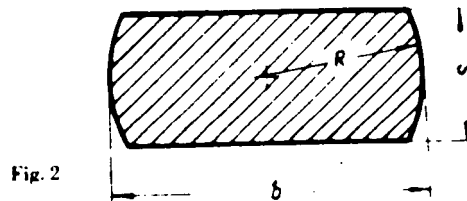


The cross-sectional dimensions of type B flats available for delivery are as follows (Table 4):

Width, mm	Thickness, mm	Radius, mm
40	5	2.5
40	7	3.5
45	5	2.5
45	7	3.5
75	10	5

TABLE 4

3. Rectangular spring steel (Fig. 2).

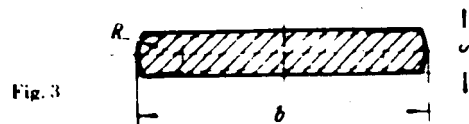


The cross-sectional dimensions of rectangular spring steel and permissible variations see Table 5.

TABLE 5

Width, mm	Thickness, mm	Radius, mm	Permissible Variations, mm	
			for width	for thickness
20	14	10	± 0.4	± 0.4
28	15	14	± 0.6	± 0.5
35	16	18	± 0.7	± 0.6
40	18	20	± 0.8	± 0.7

4. Flat spring steel type A (Fig. 3).



The cross-sectional dimensions of flat spring steel (see Table 6).

TABLE 6

Width of Flats mm	Thickness, mm														
	3	3.5	4	4.5	5	5.5	6	6.5	7	7.5	8	9	10	11	12
35	3	3.5	4	4.5	5	5.5	6	6.5	7	7.5	8	9	10	11	12
40	3	3.5	4	4.5	5	5.5	6	6.5	7	7.5	8	9	10	11	12
45	3	3.5	4	4.5	5	5.5	6	6.5	7	7.5	8	9	10	11	12
50	3	3.5	4	4.5	5	5.5	6	6.5	7	7.5	8	9	10	11	12
55		3.5	4	4.5	5	5.5	6	6.5	7	7.5	8	9	10	11	12
60		3.5	4	4.5	5	5.5	6	6.5	7	7.5	8	9	10	11	12
65			4	4.5	5	5.5	6	6.5	7	7.5	8	9	10	11	12
70			4	4.5	5	5.5	6	6.5	7	7.5	8	9	10	11	12
75					5	5.5	6	6.5	7	7.5	8	9	10	11	12
80					5	5.5	6	6.5	7	7.5	8	9	10	11	12
85						5.5	6	6.5	7	7.5	8	9	10	11	12
90					5	5.5	6	6.5	7	7.5	8	9	10	11	12
100							6	6.5	7	7.5	8	9	10	11	12
102							6	6.5	7	7.5	8	9	10	11	12
110							6	6.5	7	7.5	8	9	10	11	12
120							6	6.5	7	7.5	8	9	10	11	12
125							6	6.5	7	7.5	8	9	10	11	12
130							6	6.5	7	7.5	8	9	10	11	12
140							6	6.5	7	7.5	8	9	10	11	12
150							6	6.5	7	7.5	8	9	10	11	12

The permissible variations in width and thickness of spring steel flats shall conform Table 7.

The class of precision of steel rolling shall be stipulated in the purchaser's order.

The permissible camber of spring steel flats per 1 linear meter shall not exceed the limits indicated in Table 8.

The finned curvature is allowed only to one side along the length of the flats.

The faces of flats shall be plane and mutually parallel. The convexity of steel flats is not allowed.

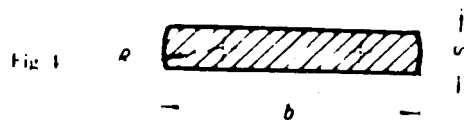
The concavity of plane surface of flats made on circumferential are shall not exceed 0.2 mm for each surface of flats. The centres of concavity radii lie on the symmetry axis of the profile.

The concavity of plane surface of flat is determined by measuring of a gap between the ruler applied to the flat and the middle of flat, with a clearance gage or a special gauge.

The radius of the edge rounding of a flat shall not exceed the thickness of the flat.

The flat spring steel can be delivered in specified lengths or multiple lengths with permissible variations ± 10 mm.

5. Spring flat steel, Type B (Fig. 4).



The dimensions of spring steel flats are indicated in Table 9.

TABLE 7

Width of Flat Profiles	Permissible Variations in width, mm		Permissible Variations Thickness						Allowable difference in thickness of edges in one cross-section of flat profile (maximum). Thickness of flats:		
	Normal Precision	High Precision	Normal Precision	High Precision	Normal Precision	High Precision	Normal Precision	High Precision	up to 7.5 mm	from 7.5 to 12 mm	over 12 mm
			Thickness up to 7.5 mm	Thickness from 7.5 to 12 mm inclusive	Thickness over 12 mm						
up to 50 mm inclusive	± 0.5	± 0.3	± 0.15	± 0.10	± 0.20	± 0.13	± 0.25	± 0.15	0.08	0.08	0.10
from 50 to 100 mm inclusive	± 0.7	± 0.4	± 0.15	± 0.10	± 0.20	± 0.13	0.25	± 0.15	0.10	0.10	0.15
			0.20	0.15	0.25	0.15	0.30	0.20			
over 100 mm	± 0.8%	± 0.5%	± 0.20	± 0.15	± 0.25	± 0.15	± 0.30	± 0.20	0.12	0.15	0.15

TABLE 8

Thickness of Flat Profiles	Camber	Permissible Camber per 1 linear meter	
		Normal precision of rolling	High precision of rolling
up to 7.5 mm inclusive	Edge camber	2.5	1.5
	Surface camber	7	5
over 7.5 mm	Edge camber	2.5	1.5
	Surface camber	4.0	3.0

TABLE 9

Width mm	Thickness mm	Width mm	Thickness mm	Width mm	Thickness mm
63	10				
76	7	102	10	130	7
76	8	102	13	130	10
76	10	114	7	130	12
76	13	114	10	150	7
80	10	120	12	150	10
80	13	120	13	150	12

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Permissible variations:

for width	1,5 per cent
for size up to 10 mm incl.	0,25 mm
for size up to 12 and 13 mm	+ 0,35 mm

The difference in thickness in one cross-section (in the direction of decreasing the thickness from the edges to the middle of the profile) shall not exceed 0,2 mm, provided that thickness tolerance is strictly maintained.

6. The spring flat concave steel (Fig. 5).

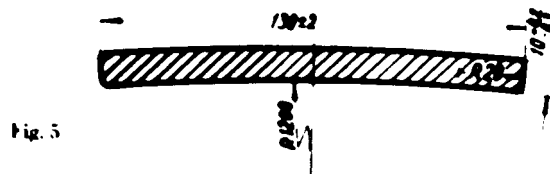


Fig. 5

7. The spring flat parabolical steel.

Dimensions of flats and permissible variations in thickness and width shall be in conformity with Table 10 (Fig. 6).

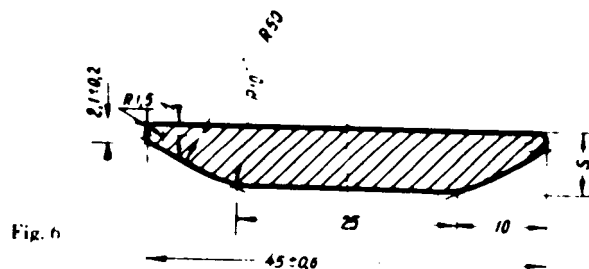


Fig. 6

TABLE 10

Thickness of Flats mm	Permissible Variations in Thickness mm	
	Normal Precision	High Precision
4,5		
5,0		
5,5	0,15	0,13
6,0	0,18	0,15
6,5		
7,0		
7,5		

The permissible camber of flat profiles per 1 linear meter shall not exceed the values indicated in Table 8.

8. Spring steel of grooved profile, Type A. (Fig. 7).



The dimensions of spring steel grooved profiles are indicated in Table 11, mm:

TABLE 11

Width <i>b</i>	Thickness <i>s</i>	<i>r</i> minimum	<i>K</i>	<i>K₁</i>	<i>r₁</i> maximum
63	10	5	4,5	3,75	3,75
63	13	5	4,5	3,75	3,75
76	7	4	3,5	2,75	2,75
76	10	5	4,5	3,75	3,75
76	11	5	4,5	3,75	3,75
76	13	5	4,5	3,75	3,75
89	10	5	4,5	3,75	3,75
89	13	5	4,5	3,75	3,75
100	13	5	4,5	3,75	3,75
110	13	5	4,5	3,75	3,75
120	12	5	4,5	3,75	3,75
120	13	5	4,5	3,75	3,75

Permissible variations:

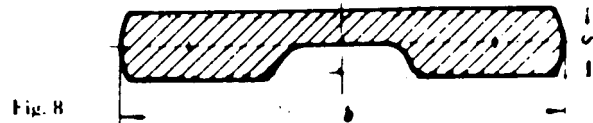
for dimensions *b* $\pm 1,5$ per cent
 for dimensions *s* up to 11 mm $\pm 0,25$ mm
 for dimensions *s* 12 and 13 mm $\pm 0,35$ mm
 for dimensions *K* $+ 0,6$ mm
 for dimensions *K₁* $- 0,5$ mm

The difference in thickness in one cross-section (in the direction of decreasing the thickness from the edges to the middle of profile) shall not exceed 0,2 mm provided that the thickness tolerances are strictly maintained.

The displacement of the arc centre of cavity and the arc centre of protrusion of the flat profile from the line of symmetry shall not exceed 0,5 mm.

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9. Spring steel of grooved profiles, Type B.



The dimensions of spring steel grooved profiles shall correspond to Table 12, mm.

TABLE 12

Width <i>b</i>	Thickness <i>s</i>	Width <i>b</i>	Thickness <i>s</i>
63	7	63	8
63	8.5	63	10
65	6	76	7
65	7	76	10

The ribbed camber of flat profiles shall not exceed 2 mm per 1 linear meter and camber over the flat plane shall not be over 5 mm per linear meter.

The bars and flat profiles are furnished in random lengths in the range from 2 to 6 m and in specified and multiple lengths stipulated in the purchaser's order.

When the flat profiles are delivered in specified and multiple lengths, the following length variations shall be allowed:

for lengths up to 4 m ± 40 mm
for lengths over 4 m ± 80 mm

The spring steel is delivered in lots consisting of flat profiles and bars of the same grade of steel, of one heat, one size and of one and the same heat treatment.

The designation of spring steel in the purchaser's order is made with indication of dimensions of bars and flat profiles, precision of rolling and grade of steel.

Flat profiles and bars of spring steel under 40 mm in thickness or diameter are furnished in bundles, each bundle securely tied with at least two metal straps. The weight of each bundle shall not exceed 80 kg. When loading and unloading is mechanized, the weight of the bundles may be greater.

Two metal tags are attached to each bundle of steel, containing the following information: grade of steel, mark number and dimensions of flat profiles and bars of spring steel.

The end faces of spring steel bars over 40 mm in thickness or diameter shall be stamped with marking. Instead of stamp the bars may be marked with a code number which should be described in the supplier's certificate.

When more than one lot of steel is shipped in one freight car, the lots shall be separated by squares.

Each delivered lot of spring steel is accompanied by the supplier's certificate in which are indicated grade of steel, mark number, profile and dimensions of flats and bars, weight of the lot and the results of all the tests prescribed in the USSR Standards for steel testing.

HOT-ROLLED SPRING STEEL FOR AUTOMOTIVE INDUSTRY

The springs and spring suspensions used in the automotive car building are manufactured of hot-rolled alloy flat and bar steel according to the USSR Standard GOST 4555-48 of the chemical composition indicated in Table 13.

At the purchaser's request steel may be furnished with narrower range of carbon content, provided the difference between the upper and lower limits of carbon content shall not exceed 0.05 per cent.

As a rule, spring steel is delivered in an unannealed state, however, on an agreement between the purchaser and the manufacturer, separate lots of spring steel flat profiles may be delivered in an annealed state.

As to the cross-sectional dimensions and length, steel flat profiles (Figs. 9 to 11) shall conform to the requirements of the purchaser's order.

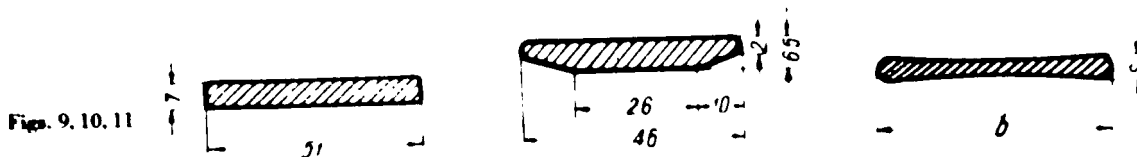


TABLE 13

Group of Steel	Grade of Steel	Chemical Composition, per cent												
		Carbon		Manganese		Silicon		Chrome	Nickel	Sulphur	Phosphorus	Vanadium		
														maximum
Silicon Steel	55C2	0.50	0.60	0.60	0.90	1.5	2.0	up to 0.3	0.3	0.04	0.04			
	60C2	0.55	0.65	0.60	0.90	1.5	2.0	up to 0.3	0.3	0.04	0.04			
	60C2A	0.56	0.63	0.60	0.90	1.6	2.0	up to 0.3	0.3	0.03	0.03			
	63C2A	0.60	0.65	0.60	0.90	1.8	2.2	up to 0.3	0.3	0.03	0.03			
Chrome-Manganese Steel	50X1	0.45	0.55	0.70	1.00	0.17	0.37	0.9	1.2	0.3	0.04	0.04		
	50X1A	0.46	0.53	0.80	1.00	0.17	0.37	0.95	1.2	0.3	0.03	0.03		
Chrome-Manganese-Vanadium Steel	50X1ΦA	0.48	0.55	0.80	1.00	0.17	0.37	0.95	1.2	0.3	0.03	0.03	0.15	0.25
Silicon-Manganese Steel	55CT	0.50	0.60	0.80	1.00	1.3	1.8	up to 0.3	0.3	0.04	0.04			
	60CT	0.55	0.65	0.80	1.00	1.3	1.8	up to 0.3	0.3	0.04	0.04			
	60CTA	0.56	0.63	0.80	1.00	1.3	1.8	up to 0.3	0.3	0.03	0.03			

Spring steel of rectangular and double-convex shapes shall be at the purchaser's request furnished with normal, high and extra high precision of rolling. The following variations in thickness and width of steel flat profiles are permitted, depending on the precision of the rolling (Table 14).

TABLE 14

Thickness and Width of Flat Profiles	Rolling Precision, mm		
	Normal	High	Extra High
Permissible Variations in Thickness			
Thickness up to 6,5 mm inclusive	+ 0,20	+ 0,18	$\pm 0,15$
over 6,5 mm	+ 0,30	+ 0,25	+ 0,15
Permissible Variations in Width			
Width up to 50 mm inclusive	+ 0,8	+ 0,8 - 0,3	+ 0,6 0,4
over 50 mm	+ 1,2	+ 1,2 - 0,3	+ 0,6 - 0,4

The following maximum permissible variations in camber of spring flat profiles in millimeters per 1 linear meter are guaranteed, depending on the rolling precision (Table 15).

TABLE 15

Thickness	Camber	Rolling precision, mm		
		Normal	High	Extra High
up to 6,5 mm inclusive	Edge camber	3,5	3,0	2,5
	Surface camber of flat profile	10,0	8,0	5,0
over 6,5 mm	Edge camber	3,0	2,5	2,0
	Surface camber of flat profile	6,0	5,5	5,0

The spring steel flat profiles are delivered in random, specified and multiple lengths. In this case, the permissible variations in the lengths of spring steel flat profiles and bars ranging from 2 to 6 meters shall be + 50 mm.

Unless the purchaser's order expressly stipulates the contrary, the deliveries of spring steel lots may contain not more than 15 per cent by weight of shorter length flat profiles and bars, but not shorter than from 1,5 to 2,0 meters.

The concavity of spring flat profiles is guaranteed in limits of 0,1 to 0,2 mm.

It is guaranteed that the surface of hot-rolled spring steel flat profiles and bars shall be clean and smooth, and when examined by the naked eye is characterized by the absence of cracks, scale, laps, blisters, hair cracks, gas cavities, sand inclusions and rolled-in scale. Slight ripple marks and thin film of scale are allowed on the surface of spring steel flat profiles and bars. The removal of local defects by chipping or grinding is not allowed.

The macrostructure of steel and its fractured surface shall be free from signs of piping, gas cavities, cracks, laminations, blisters and slag inclusions.

The hardness of an unannealed spring flat and bars, as delivered, shall conform to the requirements of Table 16.

TABLE 16

Grade of Steel	Diameter of Impression, in mm	Brinell Hardness, H _B
	minimum	maximum
55C2	3,6	285
60C2, 60C2A, 63C2A	3,5	302
50XT, 50XTA	3,4	321
50XTΦA	3,6	285
50CT, 60CT, 60CTA		

The hardness of annealed spring steel flat profiles and bars is established by additional technical specifications. When flat profiles of steel grade 50XTΦA are delivered, the hardness with the diameter of the ball impression not less than 3,3 mm (H_B not over than 341) is allowed in a quantity not exceeding 10 per cent of the lot (by weight). For steel of grades 55CT and 60CTA, the hardness values are given for information only (facultative).

The following physical properties for flat profiles of heat treated spring steel are guaranteed in the state of delivery (see Table 17).

TABLE 17

Grade of Steel	Heat Treatment (approximately)			Physical Properties			
	Hardening Temperature	Quenching Medium	Tempering Temperature	Yield Point	Tensile Strength	Elongation	Reduction of Area
	10° C		C	kg/sq. mm	kg/sq. mm	per cent	per cent
				minimum			
55C2	860	Oil	400 510	120	130	6	30
60C2	860	Oil	400 510	120	130	5	25
60C2A	860	Oil	400 510	140	160	5	20
63C2A	860	Oil	400 510	140	160	5	20
50XT	830	Oil	420 520	110	130	5	35
50XTA	820	Oil	490 520	120	130	6	35
50XTΦA	830	Oil	500 550	120	130	6	30
55CT	880	Oil	400 510	120	130	5	25
60CT	860	Oil	400 510	120	130	5	25
60CTA	860	Oil	400 510	140	160	5	25

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The values of reduction of area for steel of all grades and the values of all physical properties for steel of grades 55 CT, 60 CT and 60 CTA are given in Table 17 for information only (facultative).

The depth of the decarburization zone (ferrite plus transitional zone) of spring steel flat profiles in a state of delivery shall not exceed on one side of the profiles for all grades of steel, except silicon alloy steel, more than 2.5 per cent in width and thickness of profiles, and for flat profiles of silicon alloy steel not more than 3 per cent.

The purchaser may stipulate in the order the delivery of steel with the depth of the decarburization zone not over 1.5 per cent of the flat profiles thickness. The depth limits of the decarburization zone for steel of grades 55 CT, 60 CT and 60 CTA are given for information only (facultative).

At the purchaser's request, spring steel flat profiles in a heat treated condition are checked for the stipulated angle of bending according to the requirements envisaged by additional technical specifications.

The spring steel flat profiles of steel grade 50 XΦA are checked for grain size.

The spring steel flat profiles are furnished in lots consisting of profiles of the same grade of steel, of one melt, one size and of one and the same heat treatment.

The flat profiles of spring steel are delivered in bundles securely tied with at least two metal straps. The weight of each bundle shall not exceed 80 kg.

Two metal tags are attached to each bundle of steel containing the following information: grade of steel, melt number, lot number, dimensions of flat profiles, the standard number and supplier's plant inspection department stamp.

When loading and unloading is mechanized, the weight of the bundle may be greater than 80 kg.

Each delivered lot of spring steel is accompanied with the supplier's certificate in which are indicated: grade of steel, lot number, profile and dimensions of steel flats, weight of the lot, the results of all the tests prescribed by the USSR Standard for steel testing (including facultative tests) and the number of the standard.

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